

SHIP PRODUCTION COMMITTEE  
FACILITIES AND ENVIRONMENTAL EFFECTS  
SURFACE PREPARATION AND COATINGS  
DESIGN/PRODUCTION INTEGRATION  
HUMAN RESOURCE INNOVATION  
MARINE INDUSTRY STANDARDS  
WELDING  
INDUSTRIAL ENGINEERING  
EDUCATION AND TRAINING

October 1980  
NSRP 0007

## **THE NATIONAL SHIPBUILDING RESEARCH PROGRAM**

### **Proceedings of the REAPS Technical Symposium**

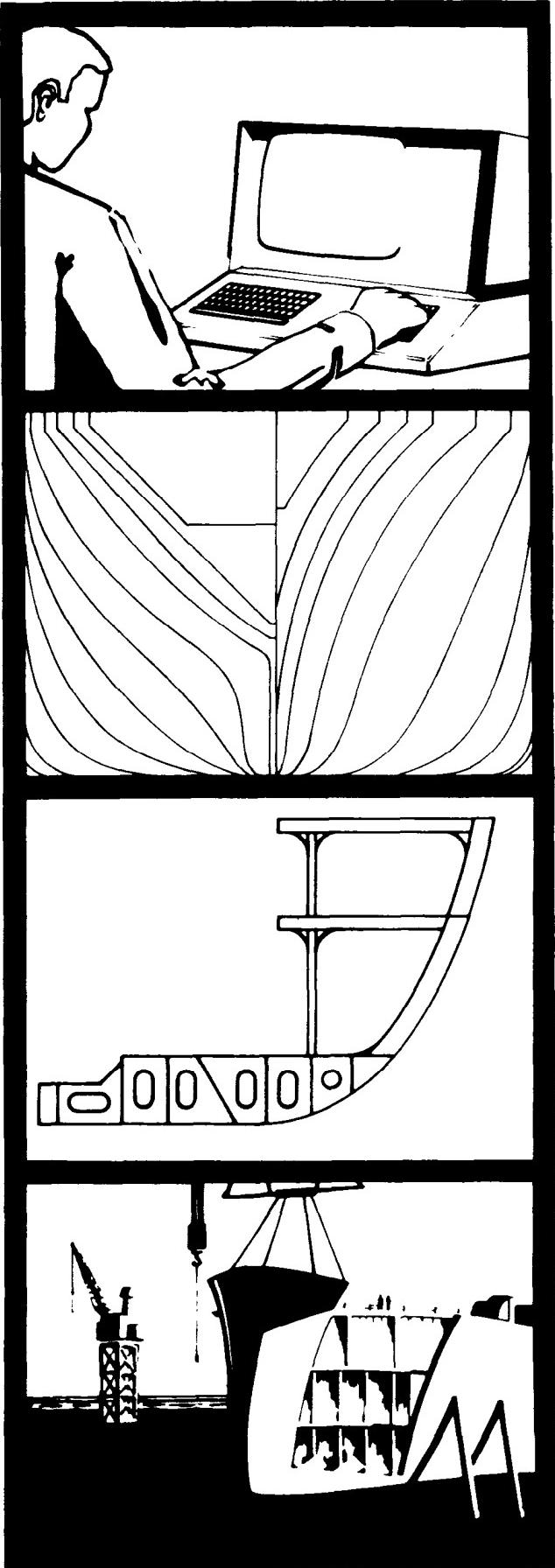
#### **Paper No. 22: Use of Autokon Design Facilities - A Designer's Presentation of an Actual Case**

U.S. DEPARTMENT OF THE NAVY  
CARDEROCK DIVISION,  
NAVAL SURFACE WARFARE CENTER

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**R**ESEARCH  
**E**NGINEERING  
**A**UTOMATION  
**P**RODUCTIVITY  
**S**IN  
HIBUILDING

**Proceedings of the**  
**REAPS Technical Symposium**  
**October 14-16, 1980**  
**Philadelphia, Pennsylvania**

**USE OF AUTOKON DESIGN FACILITIES -  
A DESIGNER'S PRESENTATION OF AN ACTUAL CASE**

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at Shipping Research Services.**

**He holds a degree in naval architecture from Newcastle University.**

# A U T O K O N      M O D U L E S

## P R E L I K O N

Products scientific calculations related to ships.  
Included are hull definition, hull variation,  
hull drawing, hydrostatics, stability, launching,  
capacities, ullage and sounding, grain stability,  
speed/power etc.

## F I L I P

Two-way connection between PRELIKON and AUTOKON.  
Generation of preliminary lines to AUTOKON.

## B O F

BOF is a programme for fairing of surfaces,  
and generates linplan and body plan complete with  
drawings and lists.

## L A N S K I

Used for completion of body plan fitting landings  
of internal shell structures on shell surfaces.  
Handles also cutout information in longitudinal  
stiffening.

## T R A L O S

Defines longitudinal surfaces internally in  
the hull, like decks with camber and sheer,  
bulkheads and stringers, and provides offsettables  
for surfaces.

## T R A D E T

TRADET defines all stiffening on surfaces defined  
by TRALOS, in addition, seams and butts of plats  
in the surfaces are defined together with cutouts  
for penetrating profiles. Defines transverse  
frames on the shell.

## D R A W

Programme for generation of graphical information  
based on data stored from TRALOS and TRADET.  
Drawings are detailed for the design and drawing  
office giving substantial improvement in total  
drawing efficiency.

Features:

- o Definition of the main surfaces in the ship
- o Definition of cut-outs
- o Definition of profiles and stiffenings
- o Definition of plate seams and thicknesses
- o Simple input to the program
- o Complete list of profiles used on the surfaces
- o Easy updating of data due to topological description
- o Generation of detailed drawings of the surfaces, including profiles and seams

For classification, steel and work drawings the modules TRALOS, TRADET and DRAW are used. These modules are used together with the other AUTOKON modules and store the results in the AUTOKON database. The results are stored both geometrically and topologically which means that the data are related to each other. By changing some data you will automatically have all related data updated as well.

This special feature makes it possible to drastically reduce the hours needed for alteration of drawings. At the same time you will always have access to the latest edition of drawings, and these drawings will show the correct geometrical results.

The TRALOS module is used for definition of any internal longitudinal surface in the ship. The surfaces can be plane (parallel to the center line or curved with chamber and sheer or twisted. Or the surface can be a combination of the mentioned. TRALOS will handle any type of conventional longitudinal surface unless it has to be faired. It can also handle inner surfaces connected to an unsymmetrical body plan. The programme can handle three main groups of surfaces depending on the transverse configuration of the surface. Horizontal surface (HSUR) defining decks, tanktop etc. which do not have any vertical lines. It will be used for symmetrical body plan. The same type of surfaces, but for unsymmetrical body plan (WSUR), and finally vertical surfaces such as girders or similar which do not have any horizontal lines. Long L bulkheads (VSUR).

TRADET

The module TRADET stores all the detailed data related to a TRALOS generated surface in the AUTOKON DATABASE, such as:

- 0 Profiles, beams and girders
- 0 Definition of all seams and butts describing type of joint, extention and related plate thicknesses
- 0 Definition of minor internal structures, including extension and connecting surfaces
- 0 Definition of connections between surfaces with necessary identification and type of connection, such as open, water tightness etc.

The profiles are split into relevant groups and will be identified with a profile number and the side of the ship where they belong. Profile orientation is established according to the "view" from which the profile is seen.

Joints between the various parts are called seams. The seams are also split into relevant groups and are identified as for the profiles. Additionally the thickness and type of weld is taken into consideration.

### DRAW

The DRAW module is used to generate drawings with different levels of detailing.

Scantling drawings which includes graphical lines of any structure penetrating the drawn surface.

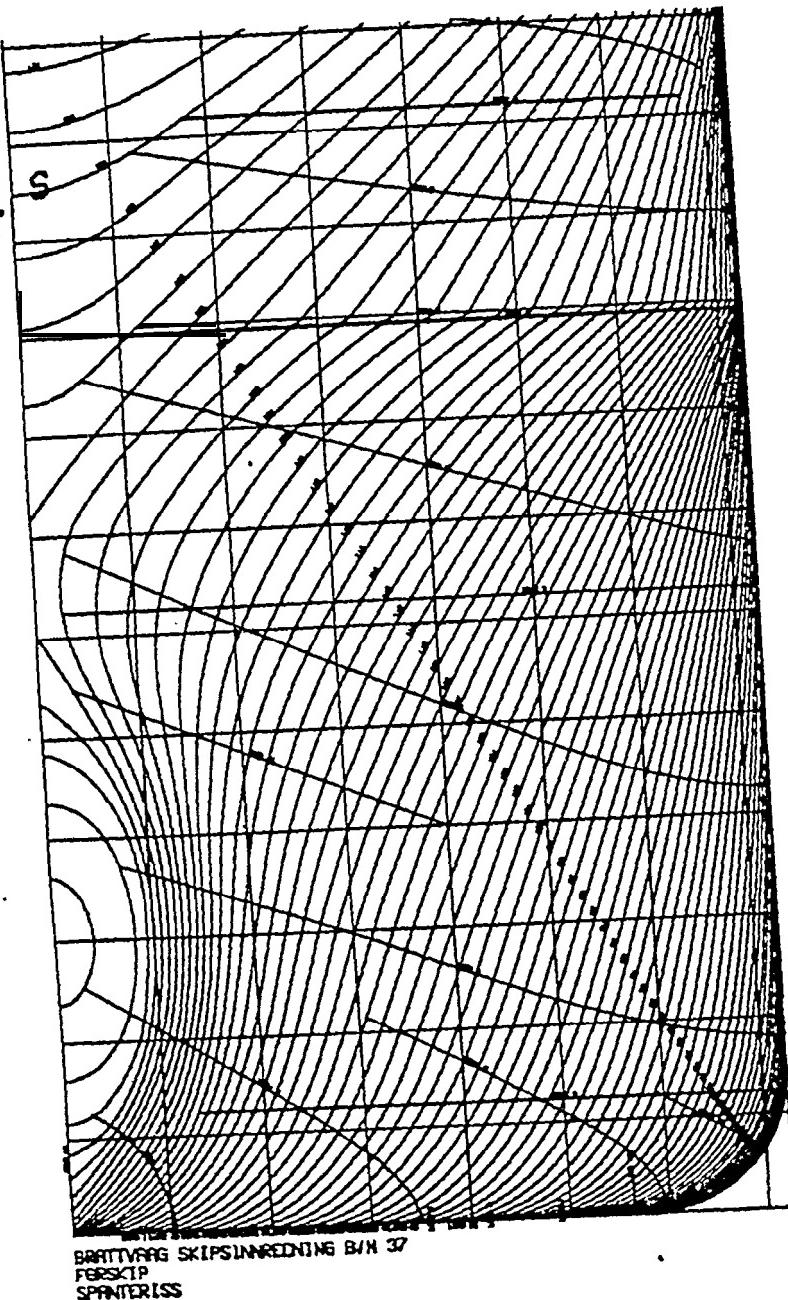
If the penetrating profiles have been defined the drawing will also include the cutout contours.

Structural drawings which include information of the scantling drawings plus the graphical details belonging to the surface itself such as:

- 0 Stiffeners
- 0 Seams
- 0 Connections of minor and major parts
- 0 Inner contours

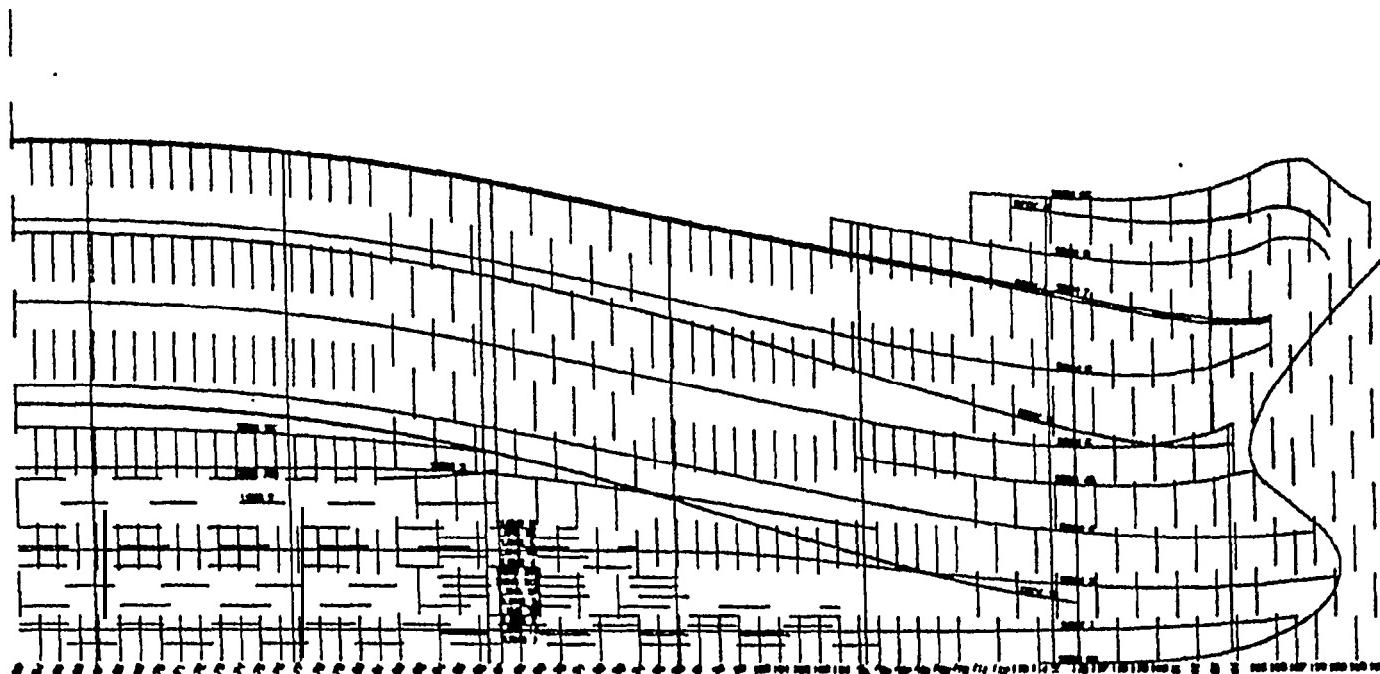
"Windows" can be defined for detailing of the drawing. Symbols are added for the seams. Stiffeners and profiles, minor or major structures, will be drawn either with a continuous line or various dotted lines depending on the type of connection and profile location. (This side or other side).

REGTARJ : RROG : R  
REGTENLIGGEN : REPOS  
REGTENLIGGEN : REPOS  
REPOS AV TEGN : T



RESTART PROG : R  
TEGN UTEN REPOS : S  
REPOS AV TEGN : T

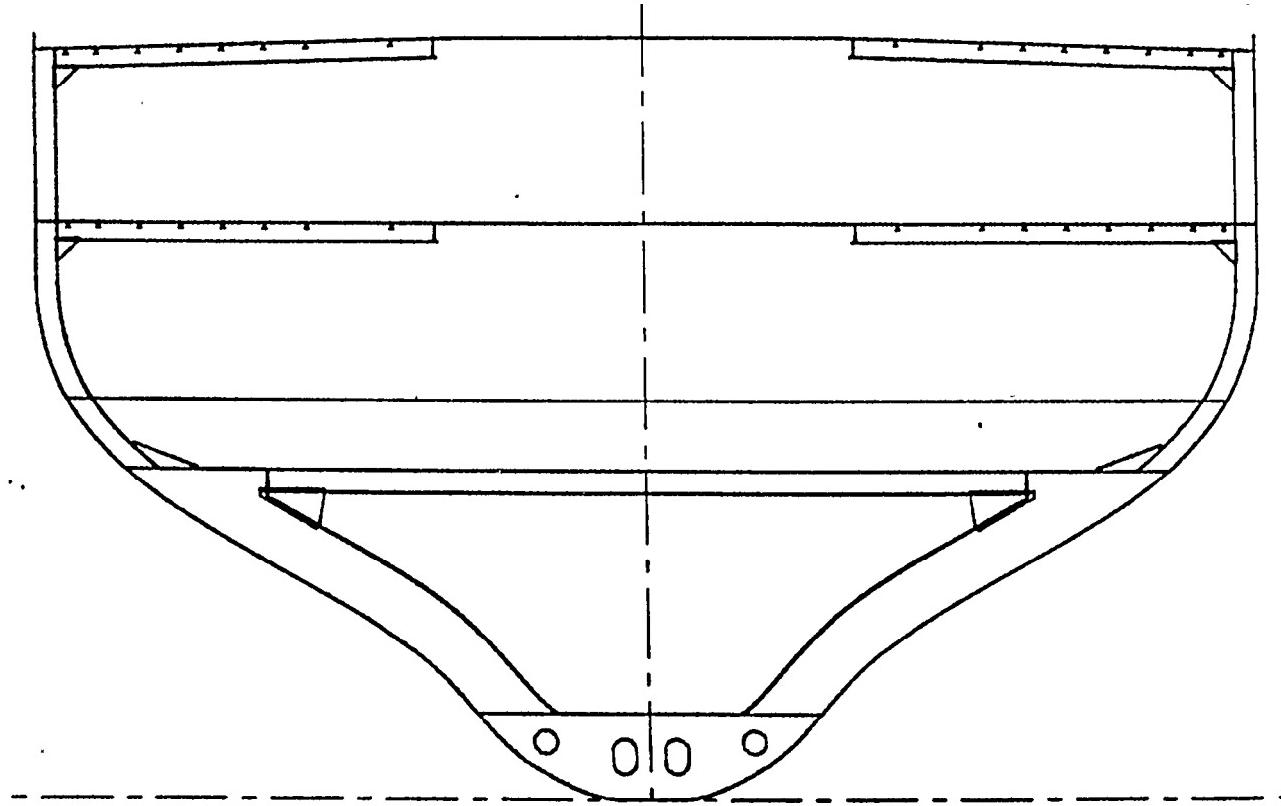
478

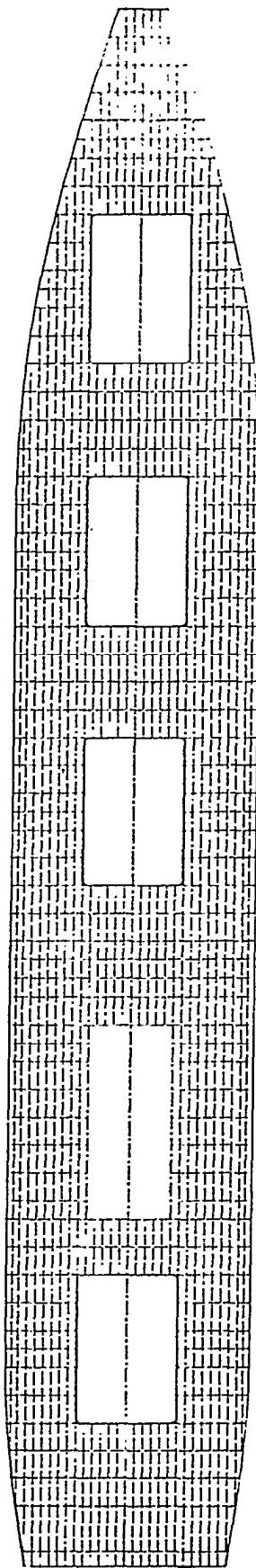


BRATTVAAG SKIPSINNR. B/N 37  
FORSKIP  
HUDUTFOLDING/SHELLEXPANSION

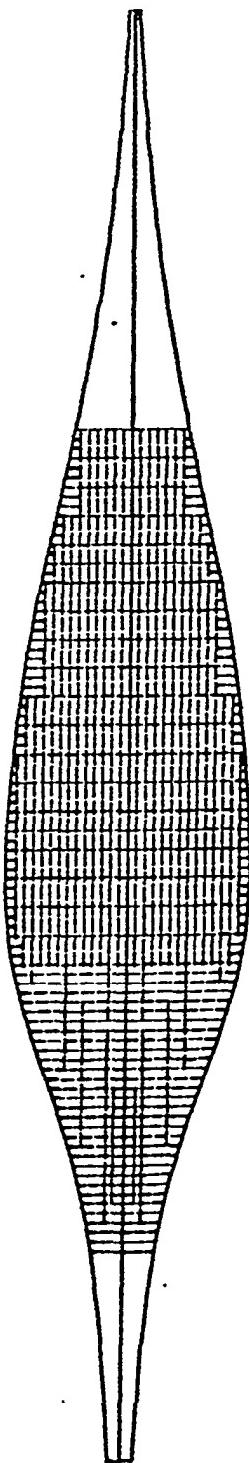
D TO YOU WANT TO CONTINUE (OR SKIP) (Y/N/SK) ... : Y  
PRACTICE PROGRAM, SAME AS BARRIER(Y/S) WILL ALSO CLEAR SCREEN  
'D' CONTINUE FROM LAST POINT

479





D  
DO YOU WANT TO CONTINUE (OR SKIP) (Y/N/SK) ?  
PARCELS ARE BEING SAVED. PARMETER(Y/N) UNTL ALSO CLEAR SCREEN  
'D' CONTINUE FROM LAST POINT



C A S E   S T U D I E S .

C H E M I C A L   C A R R I E R .

M a i n   d i m e n t i o n s :

Length over all	- - - - -	129. 6	M
Length betw. perp.	- - - - -	122. 6	M
Bredth moulded	- - - - -	19. 0	M 1
Depth moulded	- - - - -	8. 75	M
Draft summer	- - - - -	abt	6. 9M
DW Design draft	- - - - -	abt	8790 TONNES
S p e e d	- - - - -	abt	14. 3 KNOT
	- - - - -	m m	- - - - -
	- - - - -		

SRS scope of work for this. project:

Project drawings and documentation.

Classification drawings, steel, machinery,

Accommodation, outfitting.

Working drawings, steel and steel outfitting.

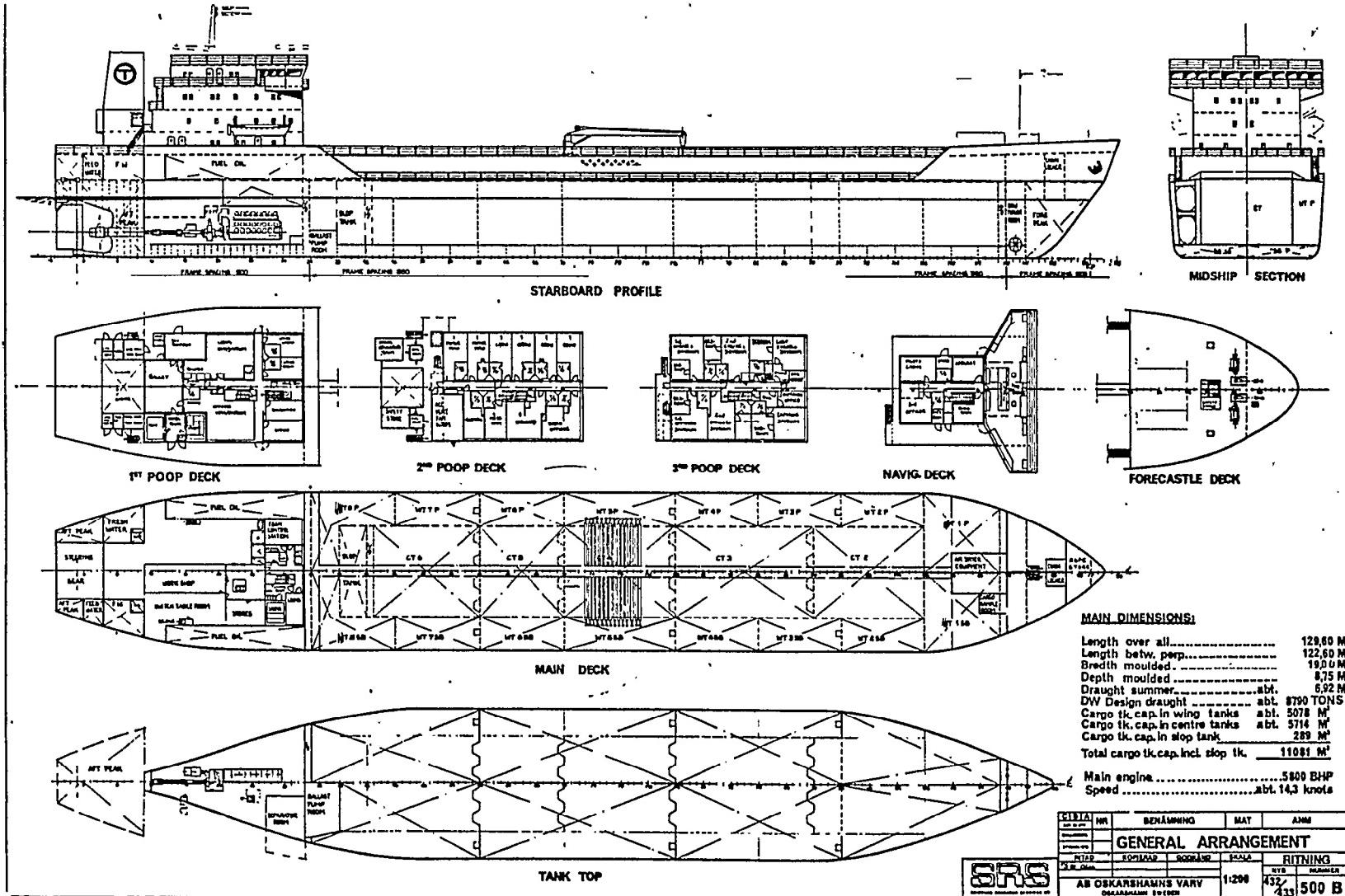
Pipe diagram, pipe arrangement and pipe scetches.

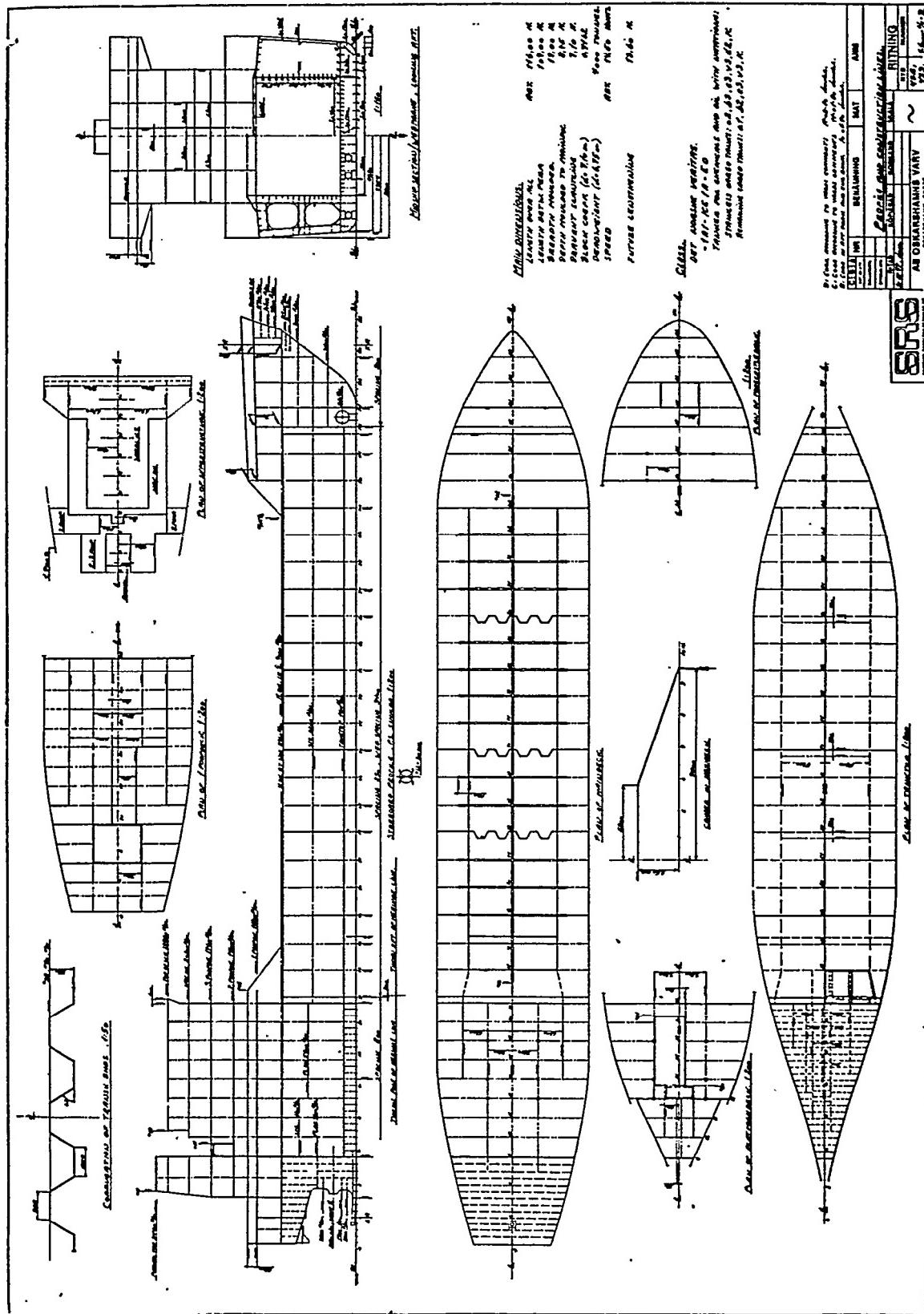
Complete lofting.

Work done for this project utilizing TRALOS and

TRADET were taken to classification level and

windows were taken to create workingdrawings.





when this project was started utilizing ITC software, the classification drawings were finished and done in the traditional way. This meant that all the classification drawings had to be defined in TRALOS and TRADET. This work were done mainly by two men. One from the lofting department and one from the structural design department.

These two men did not have any experience with TRALOS or TRADET.

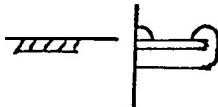
They started the work after a crush course lasting for 1.5 day, and then they were working together for about two weeks. Then the steel man was supposed to do the remaining input to TRADET, and to take out windows from the main drawings, and to assemble these to create working drawings.

During this week, it of course were detected bugs and faults in the program package. But also one of the reasons for this project were to detect faults, and then to correct the programs.

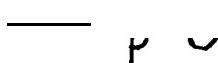
So for this project a lot of time were spent just in finding ways to get around problems, and to adjust the program.

Some of the problems we run into during the work were for instance to get the cutouts for flatbars on the correct side of the flatbar.

What we wanted



And what we got



This cutout is usually controlled by the direction of the flange of a profile.

Another funny thing we found when the lofting people started their work, the cutouts disappeared for the profiles in double bottom when they picked up the contours for the floors in double bottom.

The sequence in numbering profiles is important.

Always from centreline to shell, and from deck to bottom. In theory it should be general, but sometimes the numbering was done from bottom to deck, and that ended usually up in defaults.

The type of lines which are possible to choose in the program is somewhat restricted.

Different types available:

----- stift  
\_\_\_\_ : \_\_\_\_ girder, beams  
\_\_\_\_ : - I non water tight bulkhead  
- - - - water tight bulkhead

The control of which type of line is wanted is done by type of connections given for the different surfaces.

And for stiffeners, -ve or +ve type number of stiffener are given, -ve gives - . - . - line.

### Equipment

This project was run batch against Univac 1100. Taking out papertapes, and making the drawings with a calccumplotter. This was only to verify the content on the papertape, then the same tape was used on a Kongsberg drawing machine, and the drawing was made in ink. When using this equipment, a lot of time was wasted when waiting. First waiting for the Univac 1100 to be ready; then the checking of papertape; and final a rather slow Kongsberg drawing machine which we have. So for this project, the tool used was definitely not the best to be used.

### Economy of this Project

This item might be the most interesting part.

Total worked hours with TRALOS, TRADET and DRAW: 680 hours

of these hours about 300 hrs direct waste getting the system working.

About 100 hrs. waiting for the Kongsberg drawing machine.

The working drawings was calculated to be 4500 hours

Total hours spent for working drawings including TRALOS, TRADET and DRAW -3750 hours

Saved time 750 hours

Reduction 16,6%.

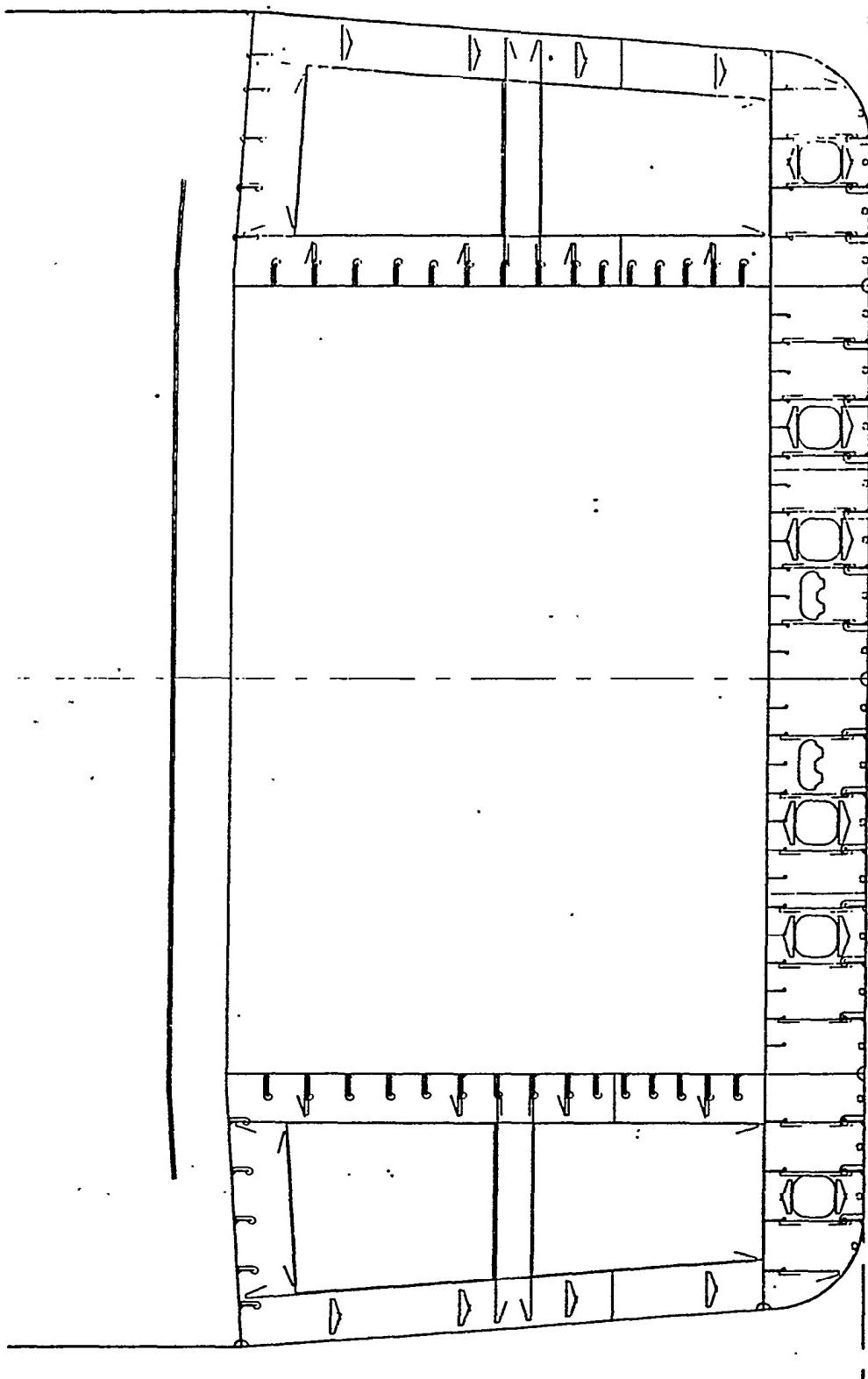
If the project was run smoothly and with better tools, about 400 hours could have been saved i.e.

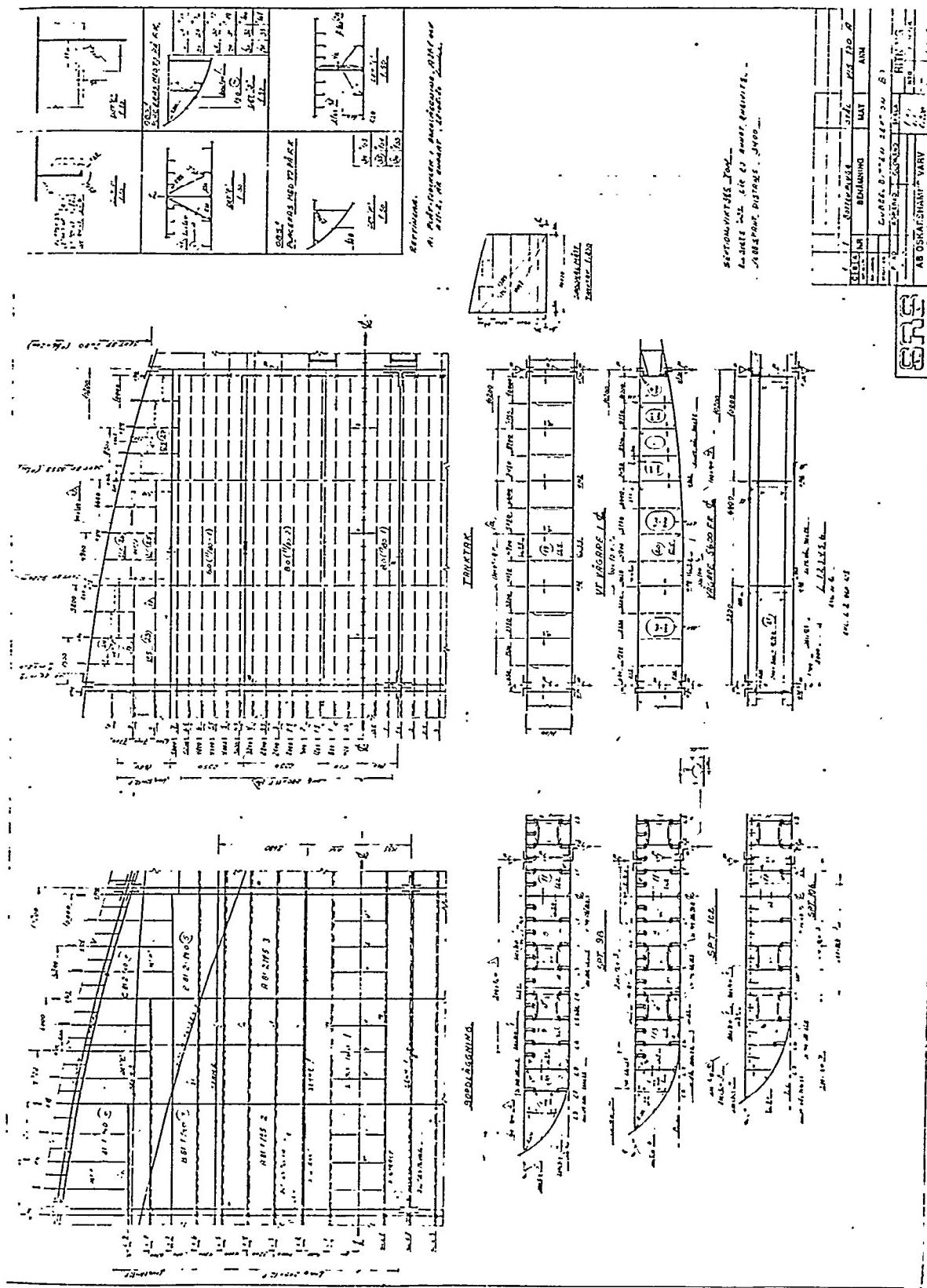
4500 hours
- 3350 hours
-----
<b>1150 hours</b>
-----

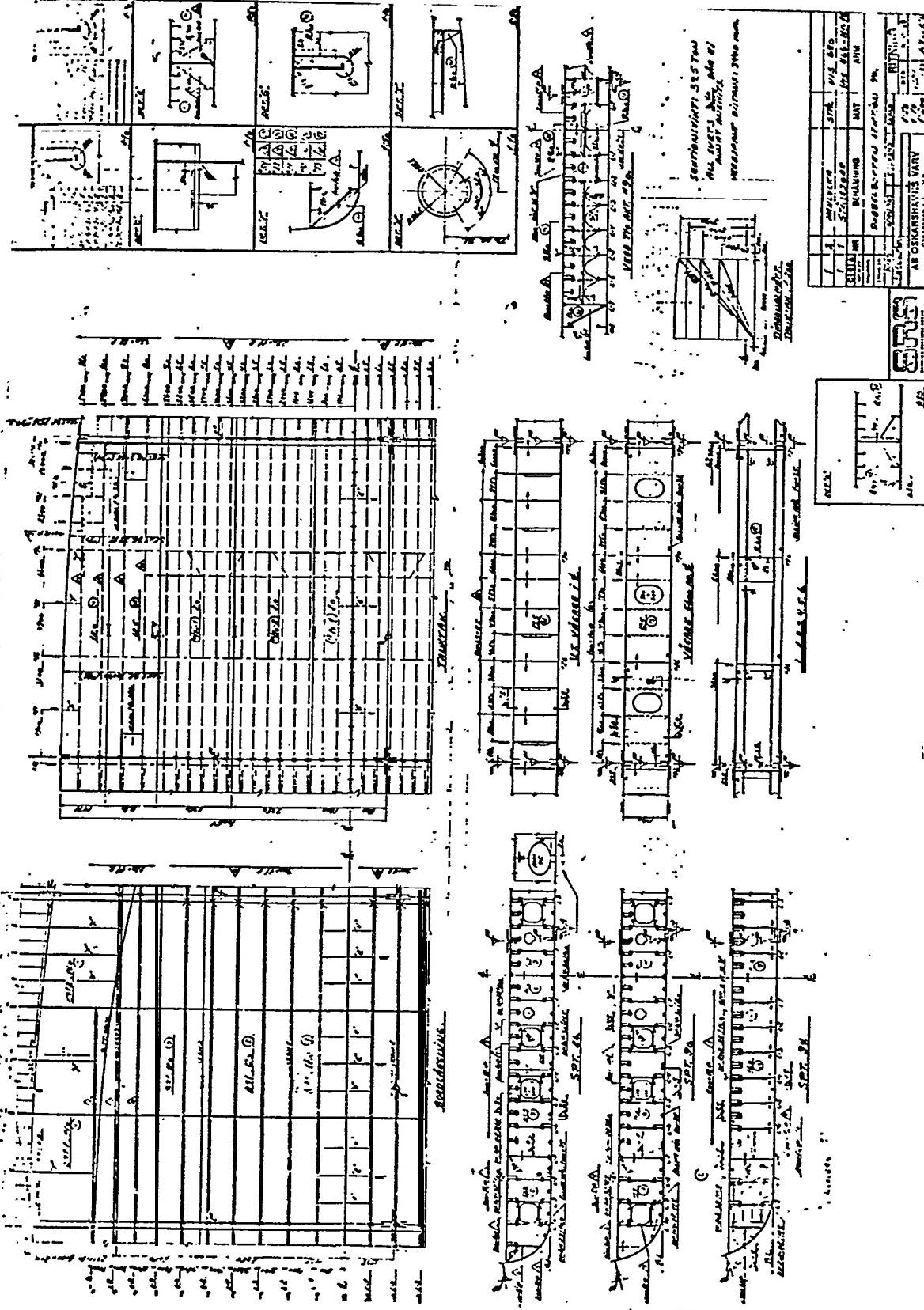
Reduction 25.5% possible.

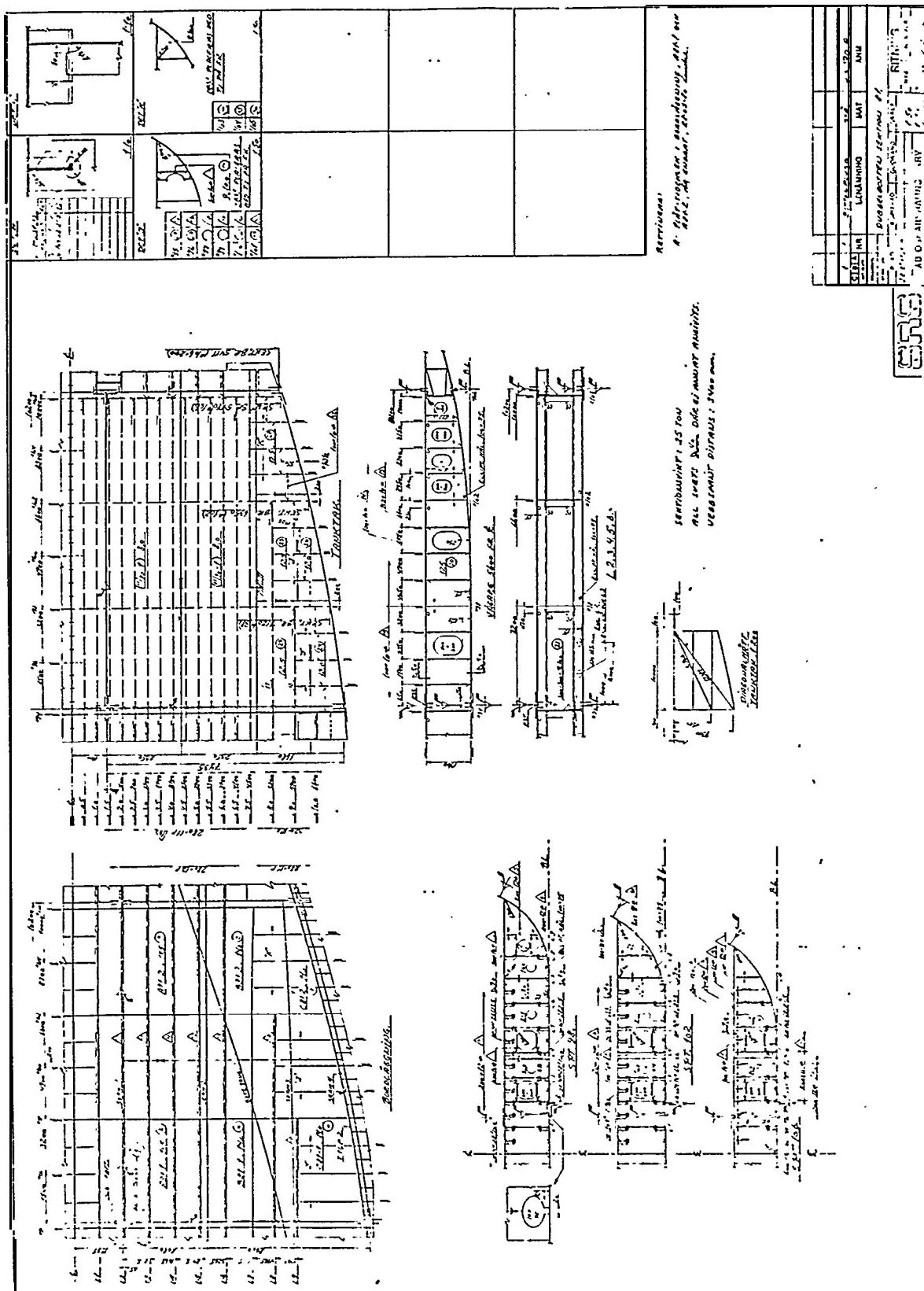
But to keep in mind, we have only been dealing with working drawings.

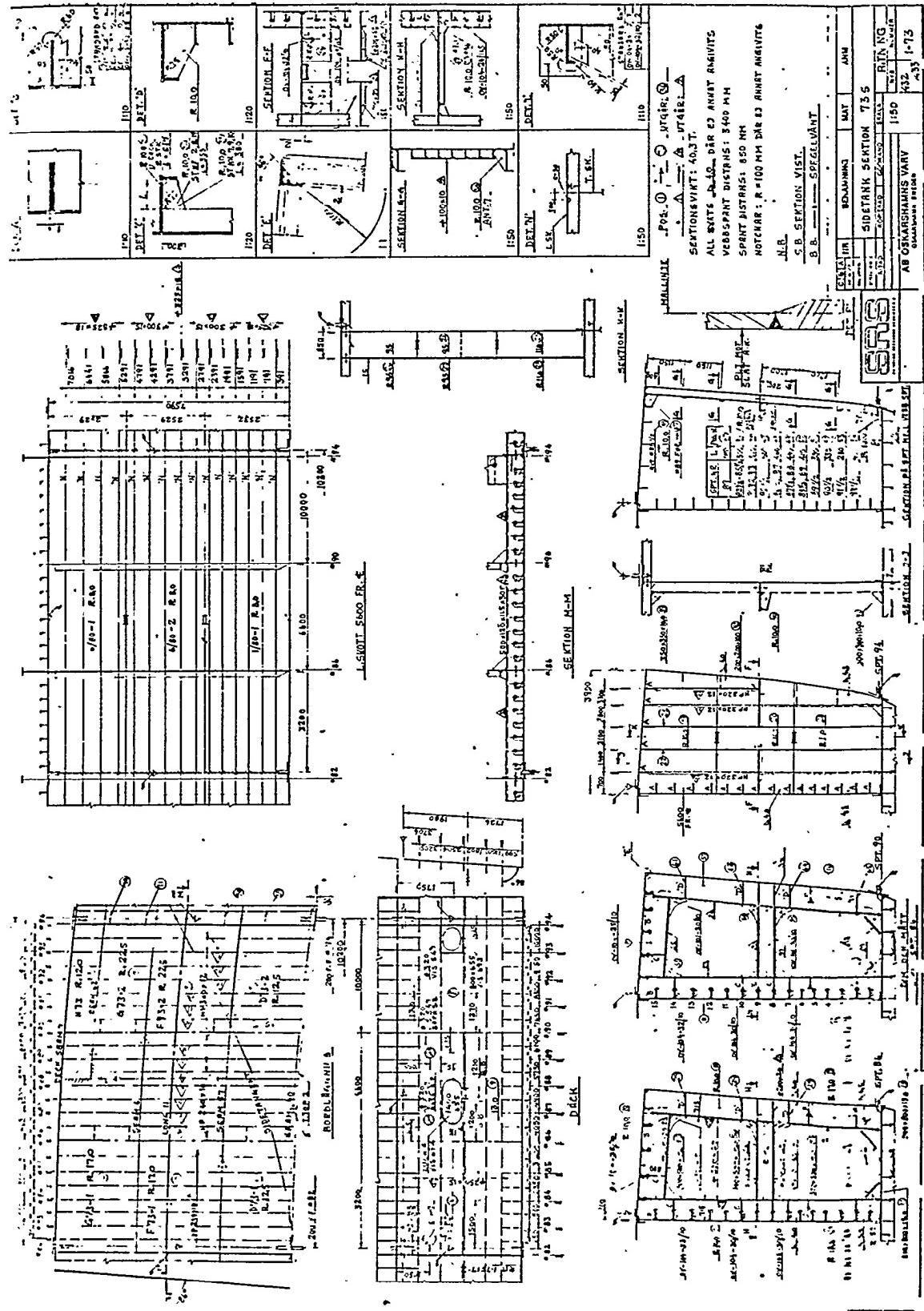
Classification drawings could have been done with TRALOS and TRADET for this project, and even more manhours could have been saved.

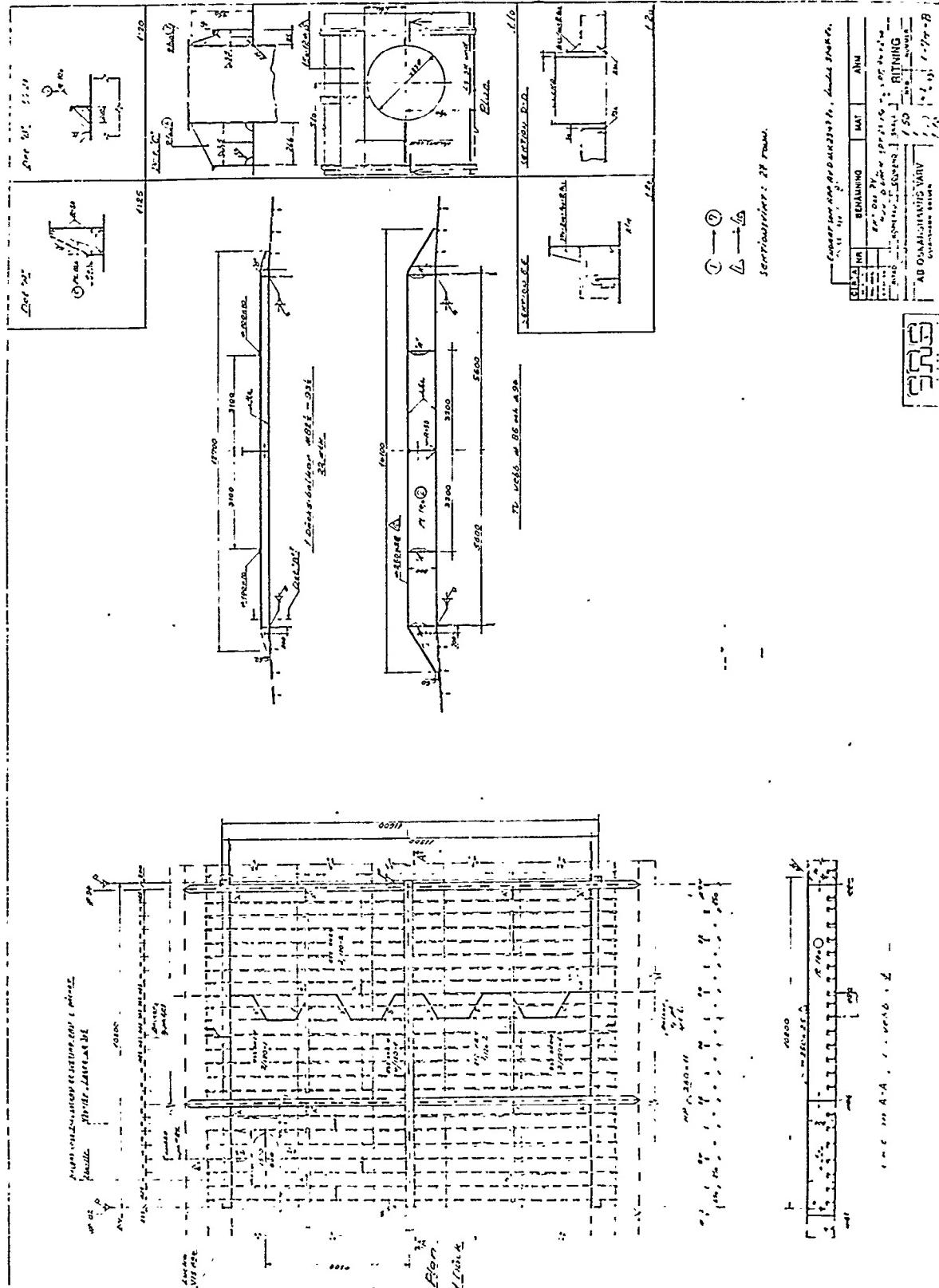


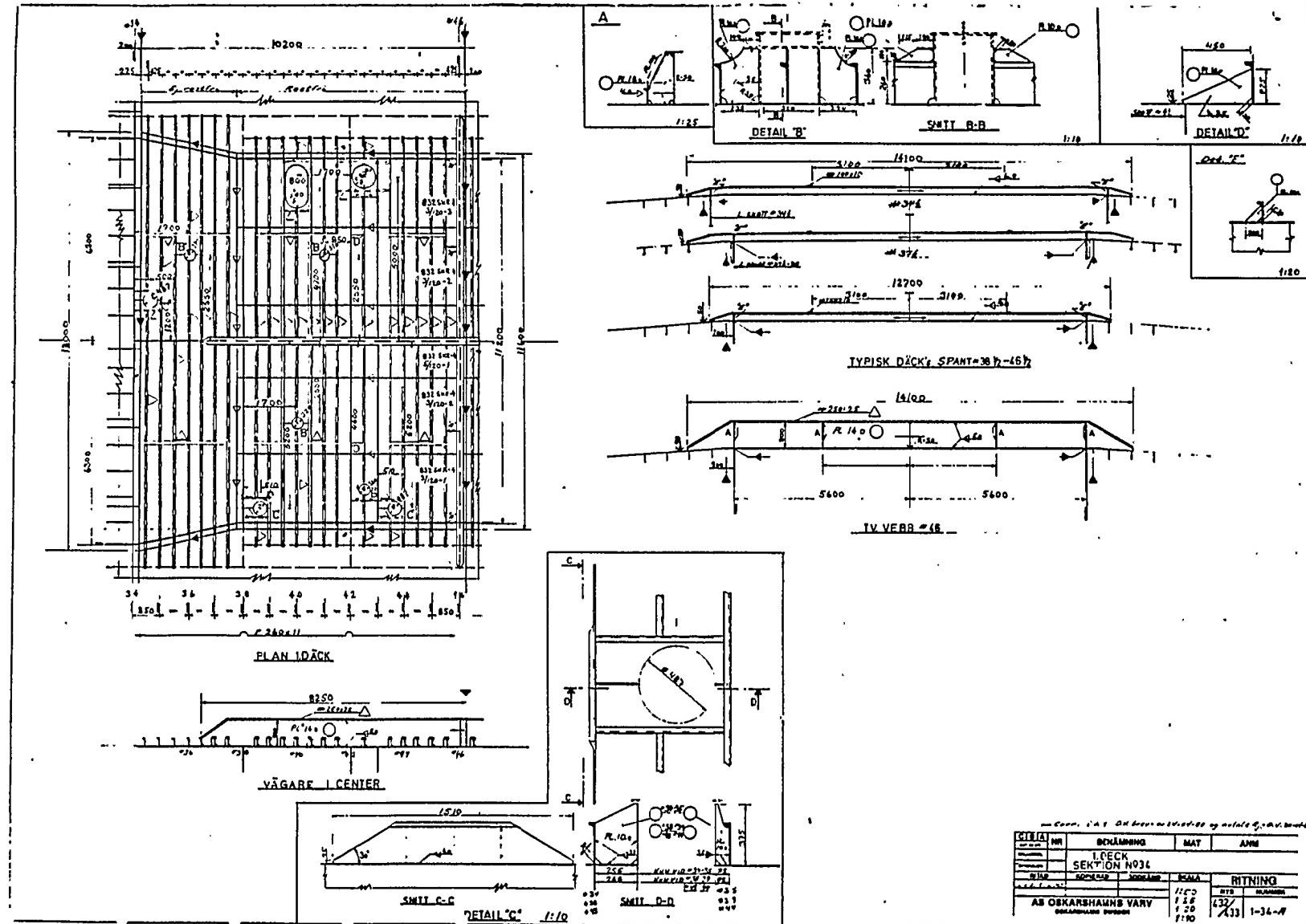












# CASE STUDIES .

## PASSENGER CARGO VESSEL

### Main dimentions:

Length over all .....	101.8 M
Length betw.perp., .....	92.4 M
Bredth moulded.....	18.0 M
Depth mouided..... m - e .....	12.0M
Depth moulded to bhd deck .....	6.8M
Max draft .....	5.0M

!

### SRS scope of work for this project:

Project drawings and documentation.

Classification drawings, steel, machinery,

Accommodation, outfitting.

Work done for this project utilizing TRALOS and

TRADET were taken to classification level.

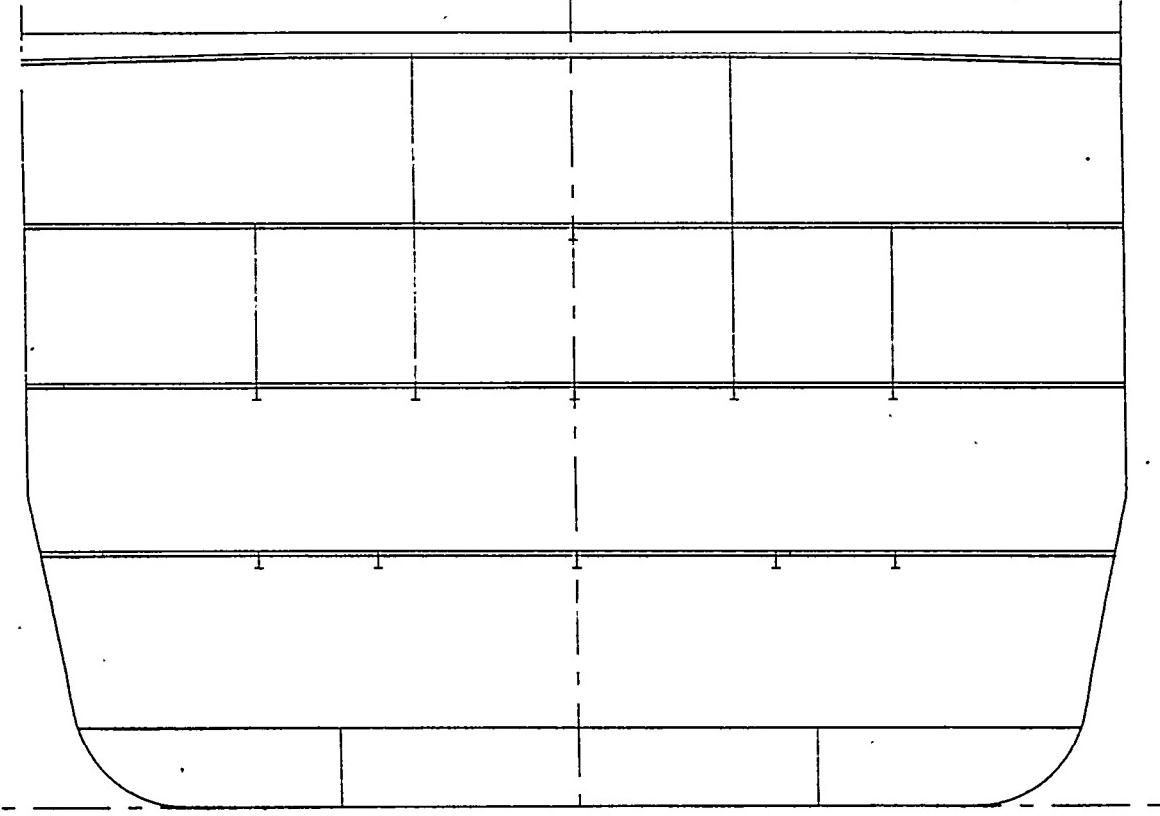
Two main purposes for this project were to test out the new version of TRALOS and TRADET, where it is possible to give the input in feet and inches, and to do the classification drawings based on preliminary lines done in Prelikon and connected to Filip to establish framenumbers which TRALOS and TRADET are dependent on. Then after fairing of lines, the preliminary lines were interchanged with the final lines.

For this project people from two other norwegian yards were joining a course together with the structural design staff. This lasted for one week, and during this week all the attendant managed to do the input for this vessel.

The actual time spent on TRALOS and TRADET were 1.5 day.

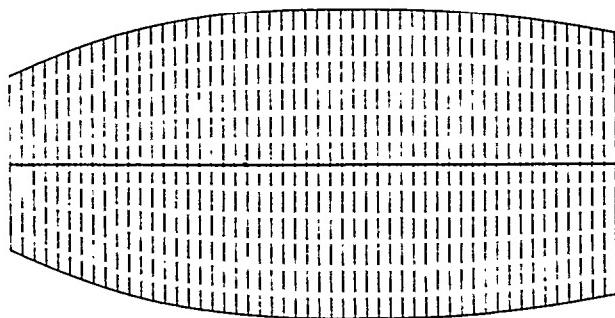
The input was done on alpha nummerical screens as a terminal to our Prime 750 Computer. Drawings taken out on a tektronix graphic screen for checking. Then finally drawn in the wanted scale on the calcompplotter.

For this project a Hewlett Packard 45B was tested out, to see how this worked as a terminal to the Prime, and also to see if the graphic screen on this desktop computer worked satisfactory. The result was satisfactory, but some minor adjustments have to be made so the system becomes more streamlined.

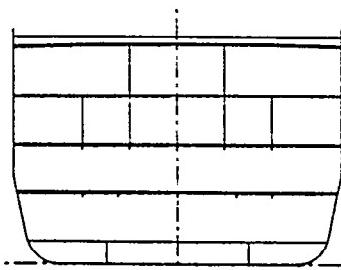


#70

PRELIMINARY LINES

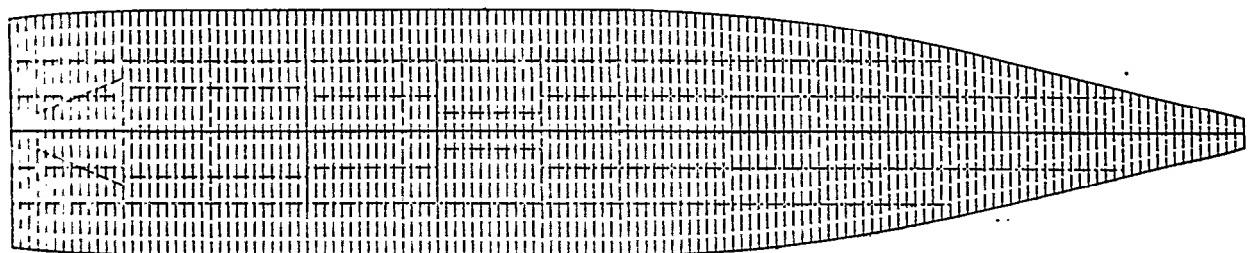


TANKTOP

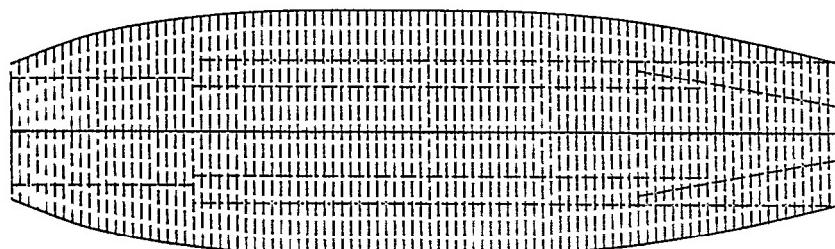


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PRELIMINARY LINES

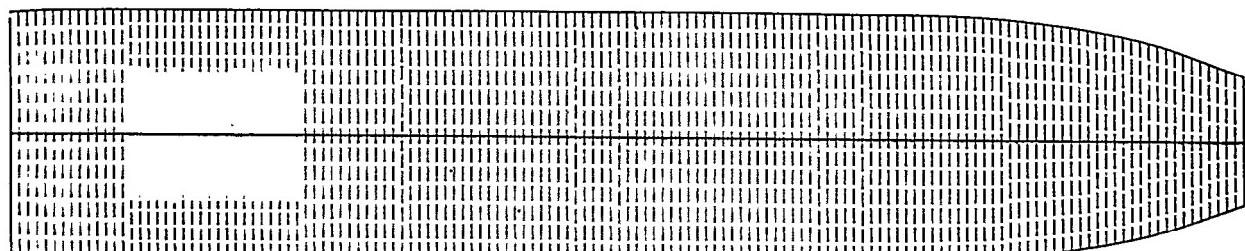


4. DECK

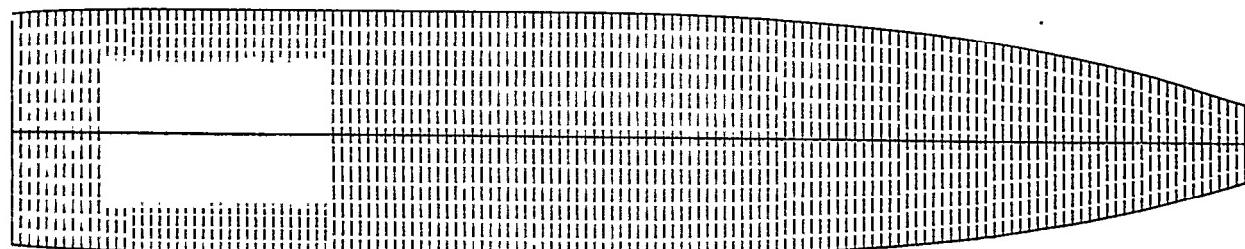


3. DECK

PRELIMINARY LINES

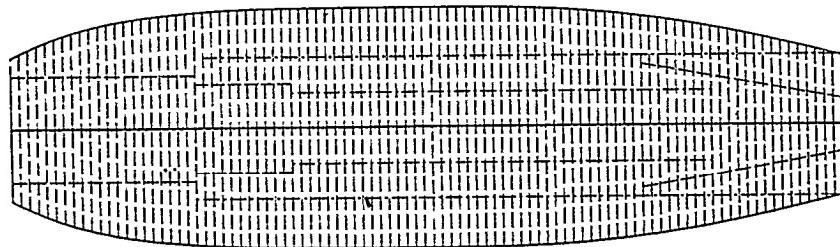


4. DECK

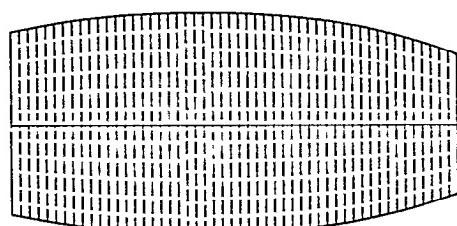


3. DECK

PRELIMINARY LINES

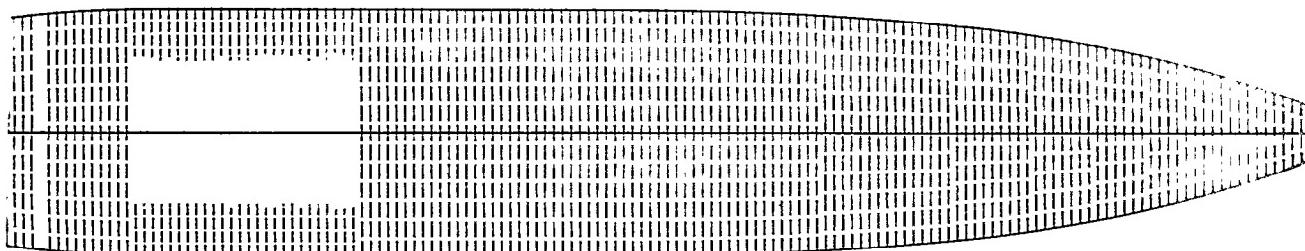


1. DECK

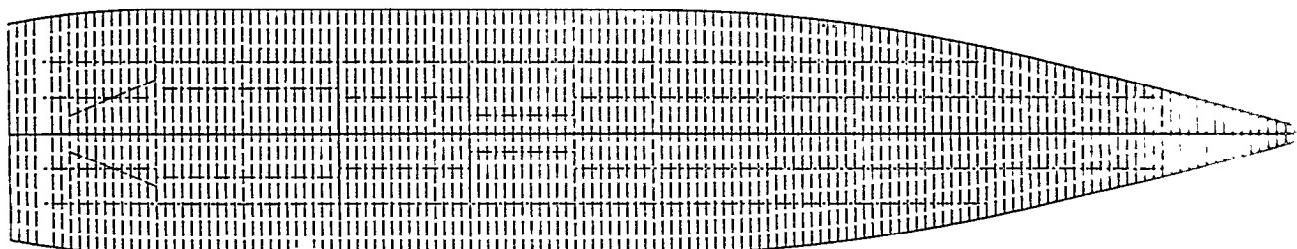


TANK TOP

FINAL LINES

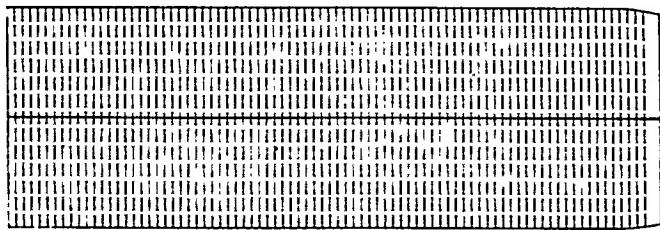


3. DECK

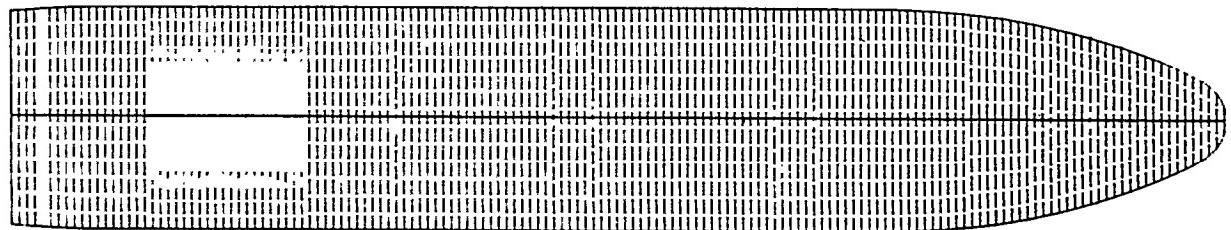


2. DECK

FINAL LINES

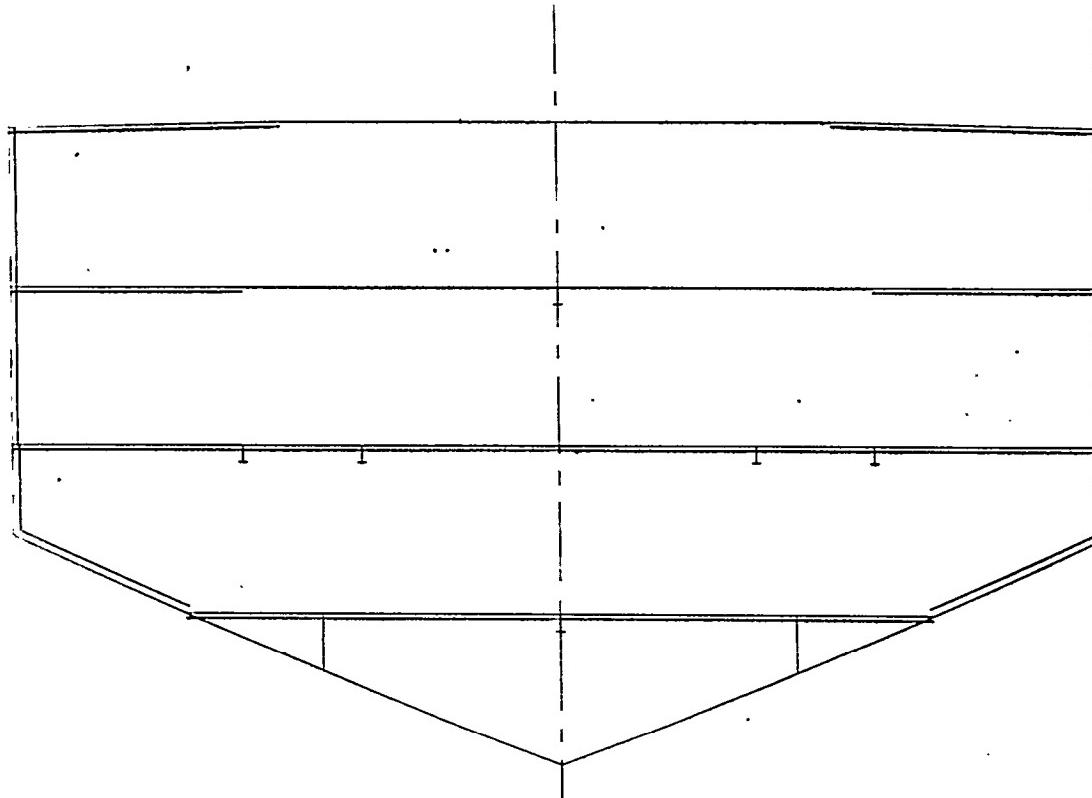


5. DECK



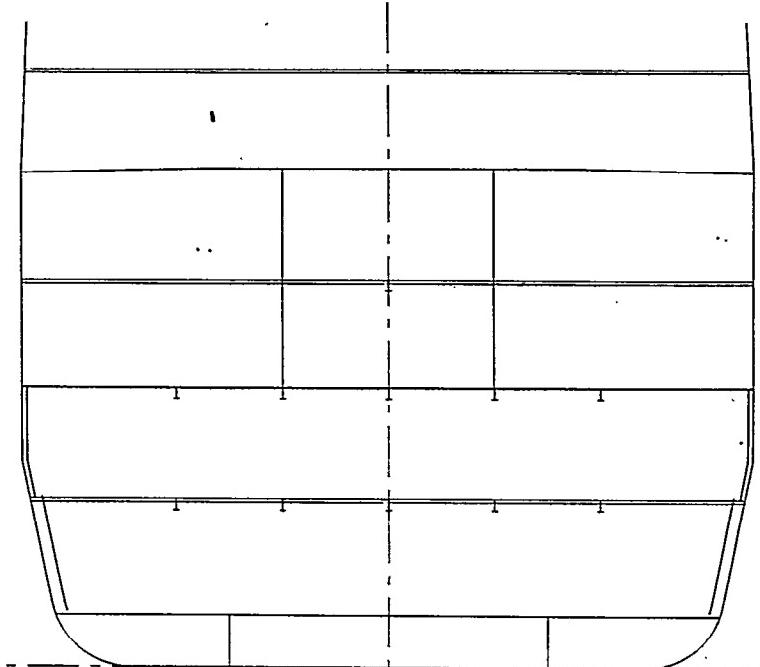
4. DECK

FINAL LINES



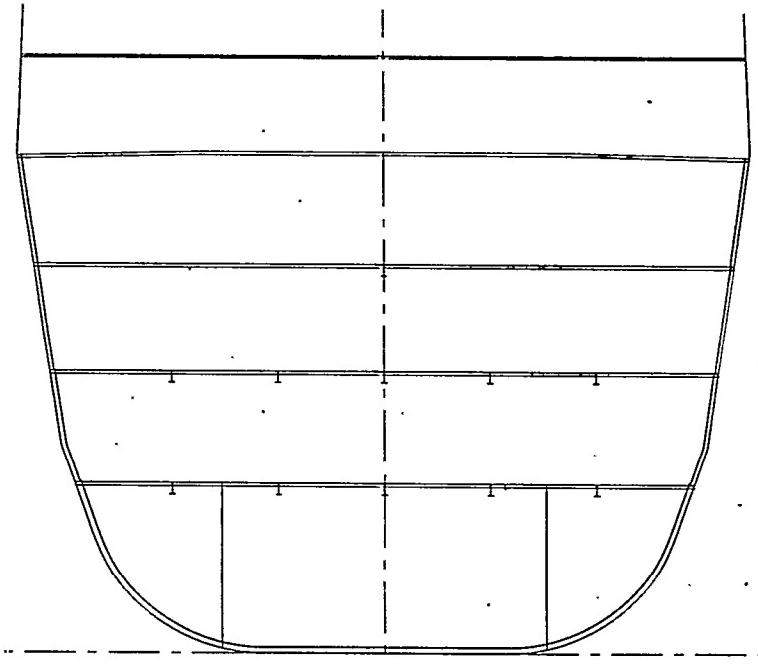
#16

FINAL LINES



#70

FINAL LINES



#90

FINAL LINES

# CASE STUDIES.

## PAPER CARRIER

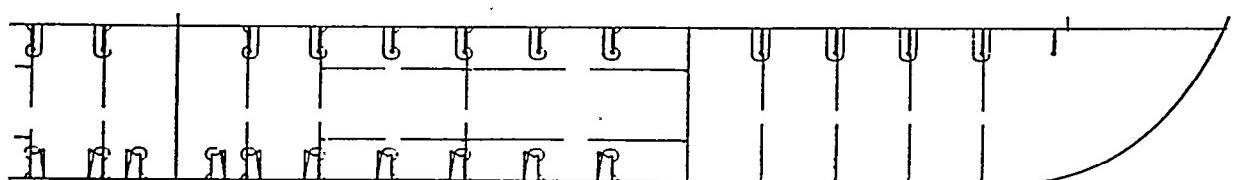
### Main - dimentions:

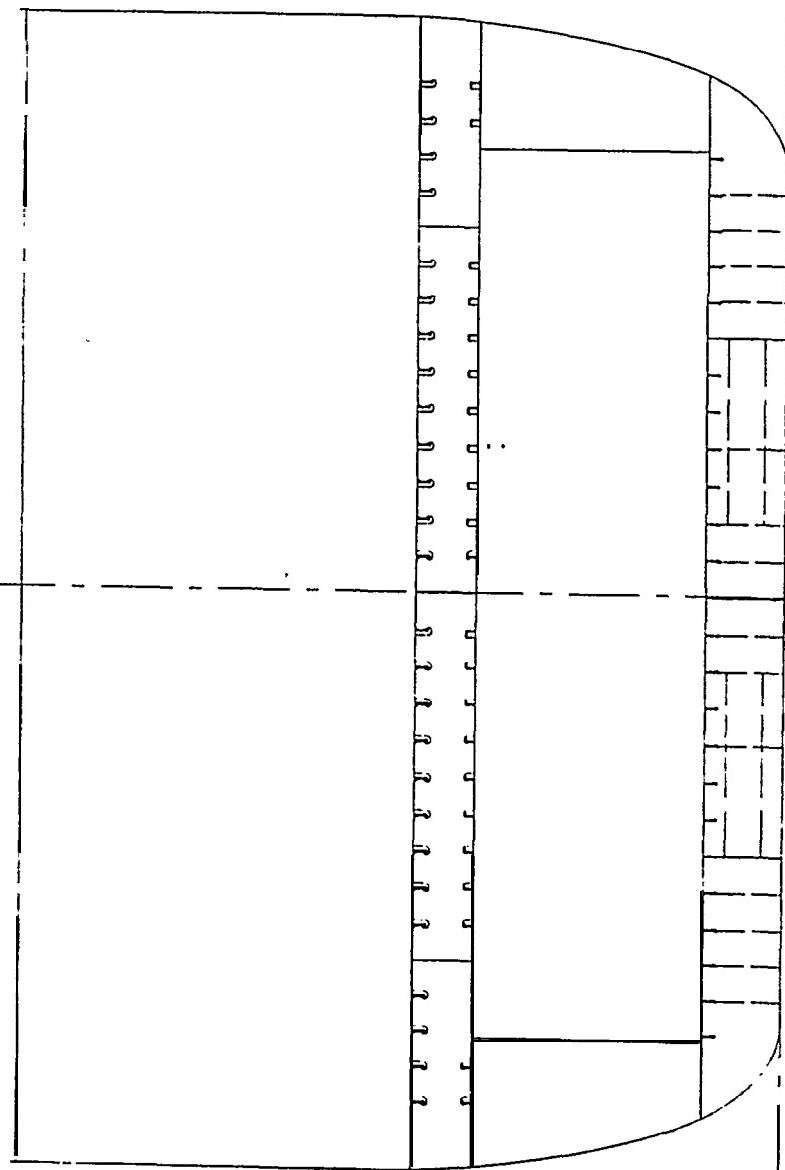
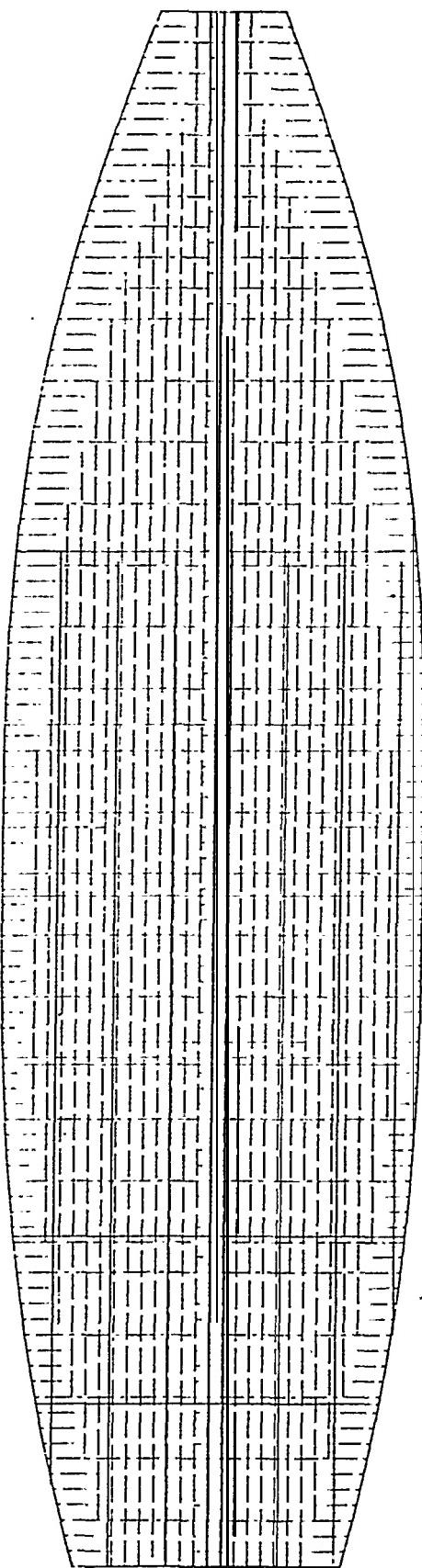
Length over all	-----	114.4 M
Length betw.perp.	-----	106.4 M
Bredth moulded	-----	18.99M
Depth moulded 1st. deck	-----	12.6 M
Depth moulded 2nd. deck	-----	5.9M
Max draft	-----	5.9M
Cb	-----	0.662

SRS scope of work for this project:

Create setteup for workingdrawings.

This were deliwerd to the shipyard drawing office  
for completion with texting etc.





## C A S E      S T U D I E S

Box structures

Superstructures

Hatch covers

For all the other cases, we had a shipshape structure, and why not test it out on the simplest structure? A box shaped vessel or anything which are box shaped.

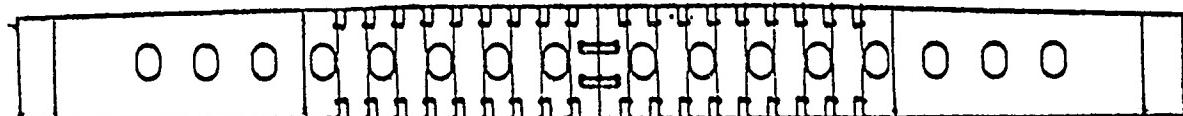
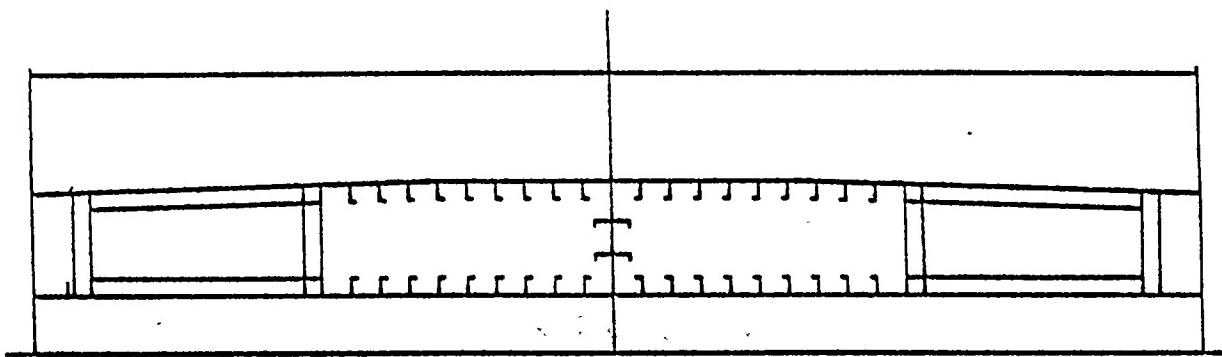
TRALOS and TRADET are dependent on framenumbers so we have made a database which are boxshaped in Alkon.

By doing this, we needed not to use Bof or Lanski.

The result can be seen on the following drawings.

Input time for this result were 5 hours.

```
DO YOU WANT TO CONTINUE (OR SKIP) (Y/N/SK) ..... 1 Y
ALL ● PARAMETERS SAME AS BEFORE? (Y/N) ..... ? Y
PLACE CROSSHAIR, TYPE A CHARACTER. 'C' WILL ALSO CLEAR SCREEN
DO YOU WANT TO CONTINUE (OR SKIP) (Y/N/SK) ..... 1 Y
ALL PARAMETERS SAME AS BEFORE? (Y/N) ..... ? Y
PLACE CROSSHAIR TYPE A CHARACTER. 'C' WILL ALSO CLEAR SCREEN
DO You WANT TO CONTINUE (OR SKIP) (Y/N/SK) ..... 1 Y
ALL PARAMETERS SAME AS BEFORE? (Y/N) ..... ? Y
PLACE CROSSHAIR TYPE A CHARACTER 'C' WILL ALSO CLEAR SCREEN
DO YOU WANT TO CONTINUE (OR SKIP) (Y/N/SK).... . . . 1
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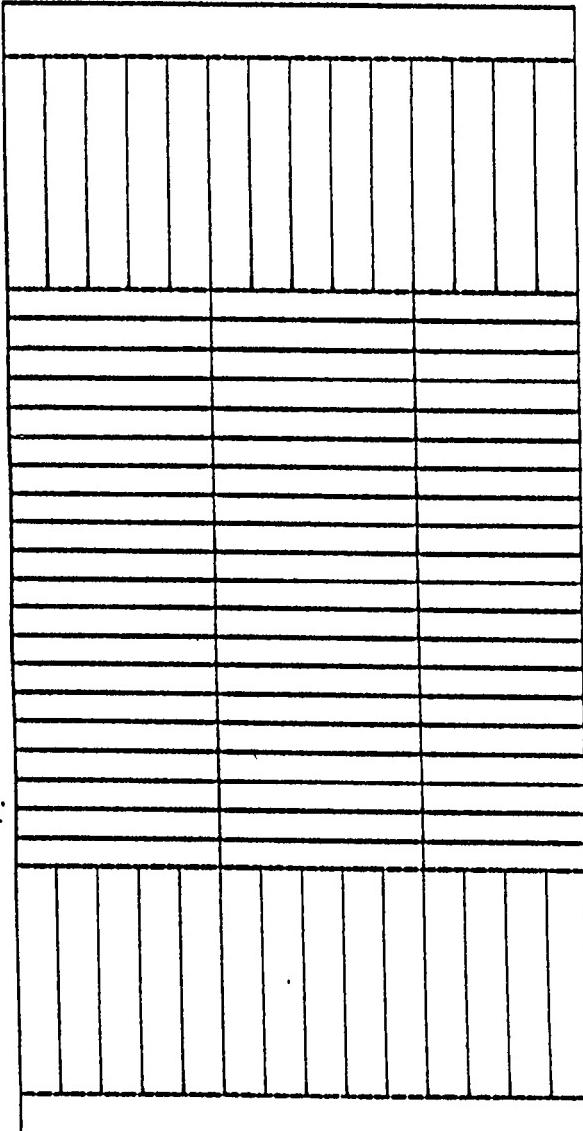


**DO YOU WANT TO CONTINUE (OR SKIP ) (Y/N/SK) ..... 1 Y**

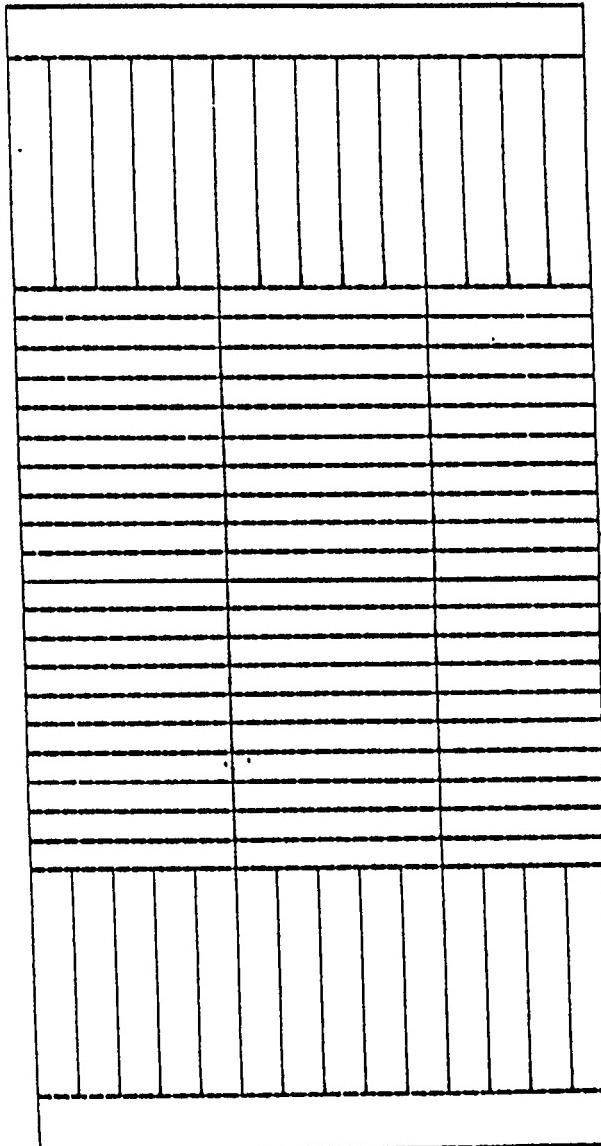
ALL PARAMETERS SAME AS BEFORE? (Y/N)

PLACE CROSSHAIR, TYPE CHARACTER. 'C' WILL ALSO CLEAR SCREEN  
DO YOU WANT TO CONTINUE (OR SKIP) (Y/N,SK) ..... 1

504



PLACE CROSSHAIR, TYPE A CHARACTER. 'C' WILL ALSO CLEAR SCREEN  
DO YOU WANT TO CONTINUE (OR SKIP) (Y/N/SK) ..... :



### A DESIGNERS WORKING PLACE

The situation have changed considerably the last years for the staff in the drawing office.

The manhour cost is increased compared with computercosts.

So one way to increase the efficiency and accuracy of the designer is to invest money in hardware and software.

In our office we will have working station (Alpha nummerical screens) for each designer. He will do the input for structural drawings on his own place.

Also an Hewlett Packard 45B topdesk computer, will be sheared between working places. This is also acting as a terminal to our Prime 750. On this H.P. 45B most project work and strength calculations can be done. Also checking of drawings on the graphic screen is possible.

After this checking the drawings or drawn out in the wanted scale on a calcumppplotter.

This equipment will of course increase the cost of a designeres working place, but compared with all dead time in running batch systems, I think this type of investment is recommendable. •

## CONCLUSIONS

It is possible to save manhours with this system from 10% to 40% depending on the skillness of people, and the tools which are given to the designer.

The system is also more suitable for some special vessels.

Eg. tankers, (lot of longitudinal numbers)

Passenger vessel with lot of decks

Ro-Ro vessels.

I.e. vessels with repeating items in the structure.

As the system is working now, there is information which could be better utilized.

I am thinking of steel specification of plates and profiles.

(Now we get profile length and seam length).

This can be coupled to a material program and that means we can have a preliminary steel specification on a very early stage.

For lofting some information in the system can be used but this is only minor parts. When this part of the system is linked together with Autopart and Autonest, we really have a system covering a vessel from project stage to production stage.

Additional copies of this report can be obtained from the  
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